

# **MLS strato-mesospheric CO validation**

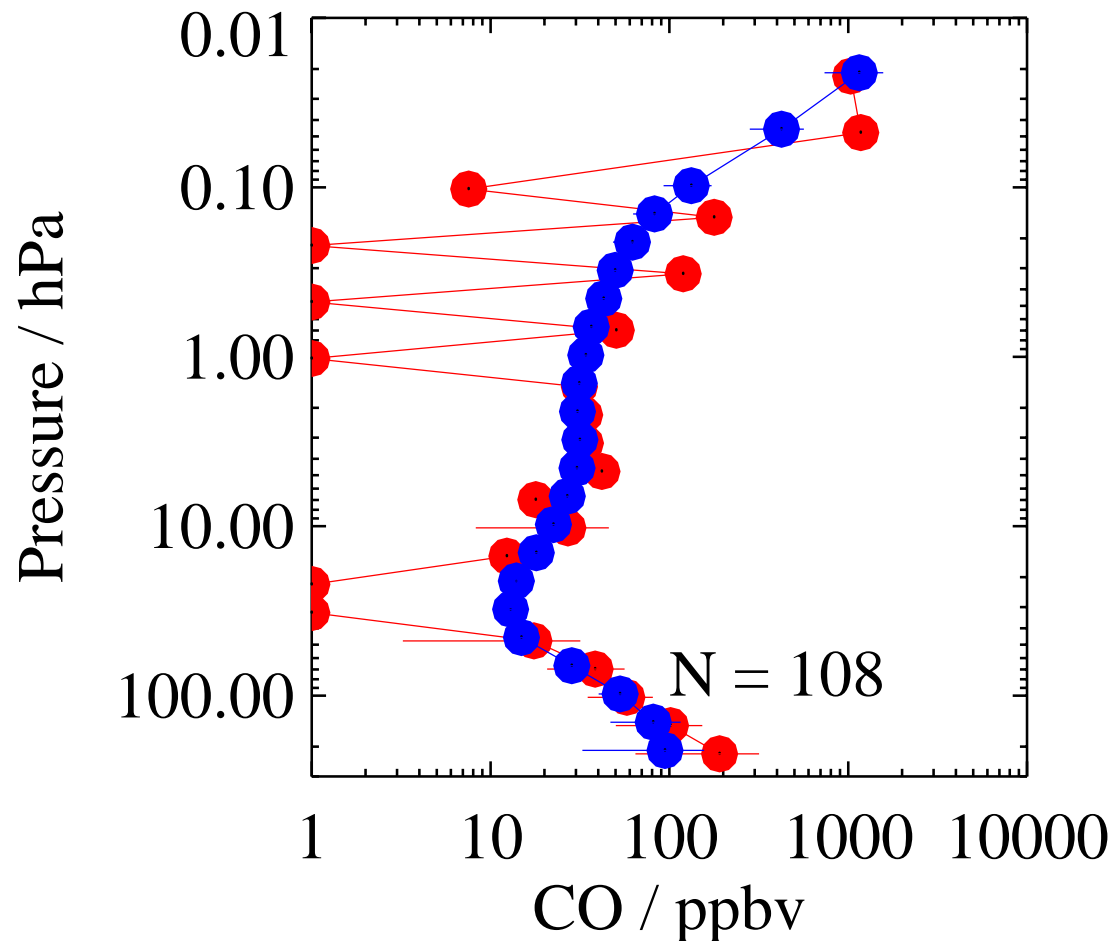
**ACE**

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## MLS and ACE CO

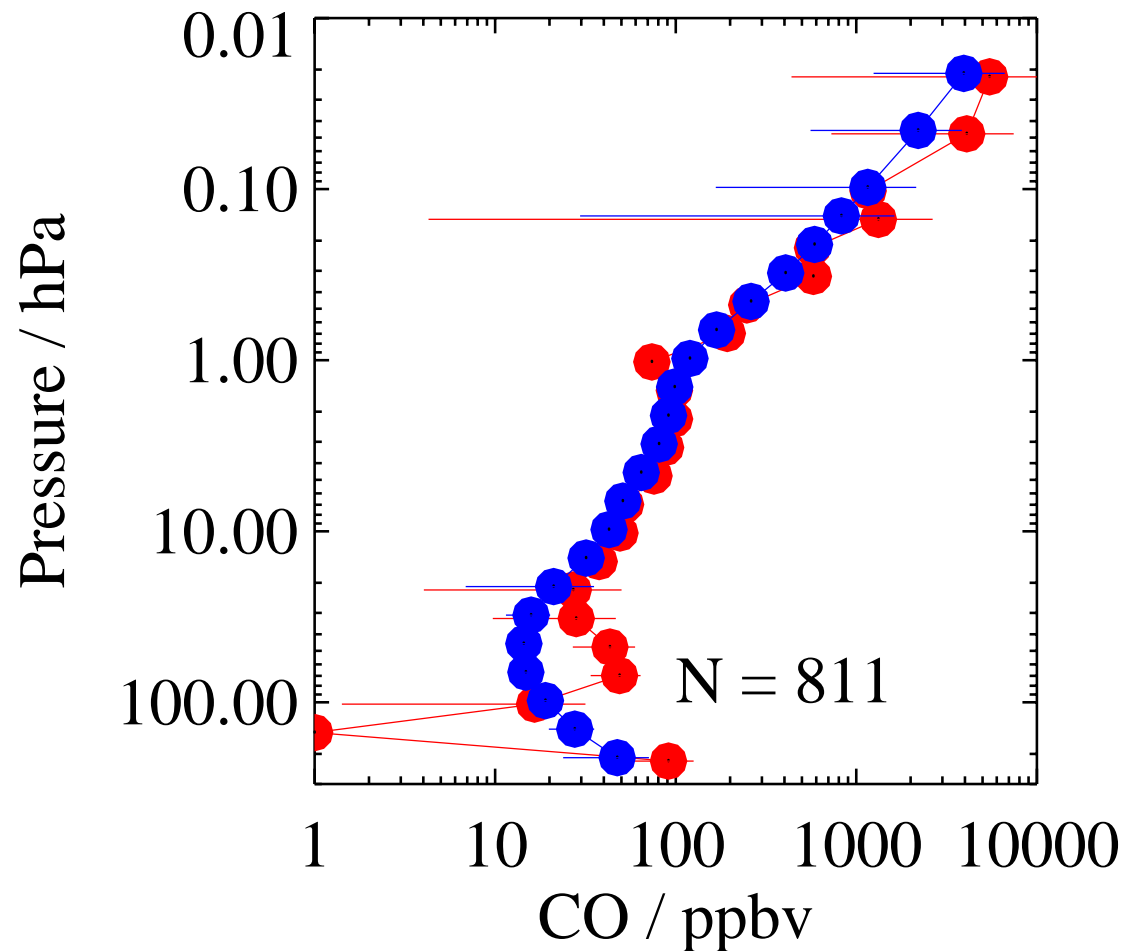
- One year (August 2004–August 2005) of MLS data compared with ACE occultation data.
- Over 2000 coincidences (including 100 in the tropics) within  $1^\circ$  latitude,  $8^\circ$  longitude, 12 hours time.
- MLS and ACE vertical resolutions are similar ( $\sim 4$  km), so ACE data has been simply interpolated to the MLS pressure levels.

## MLS and ACE CO: Tropics, 20S–20N



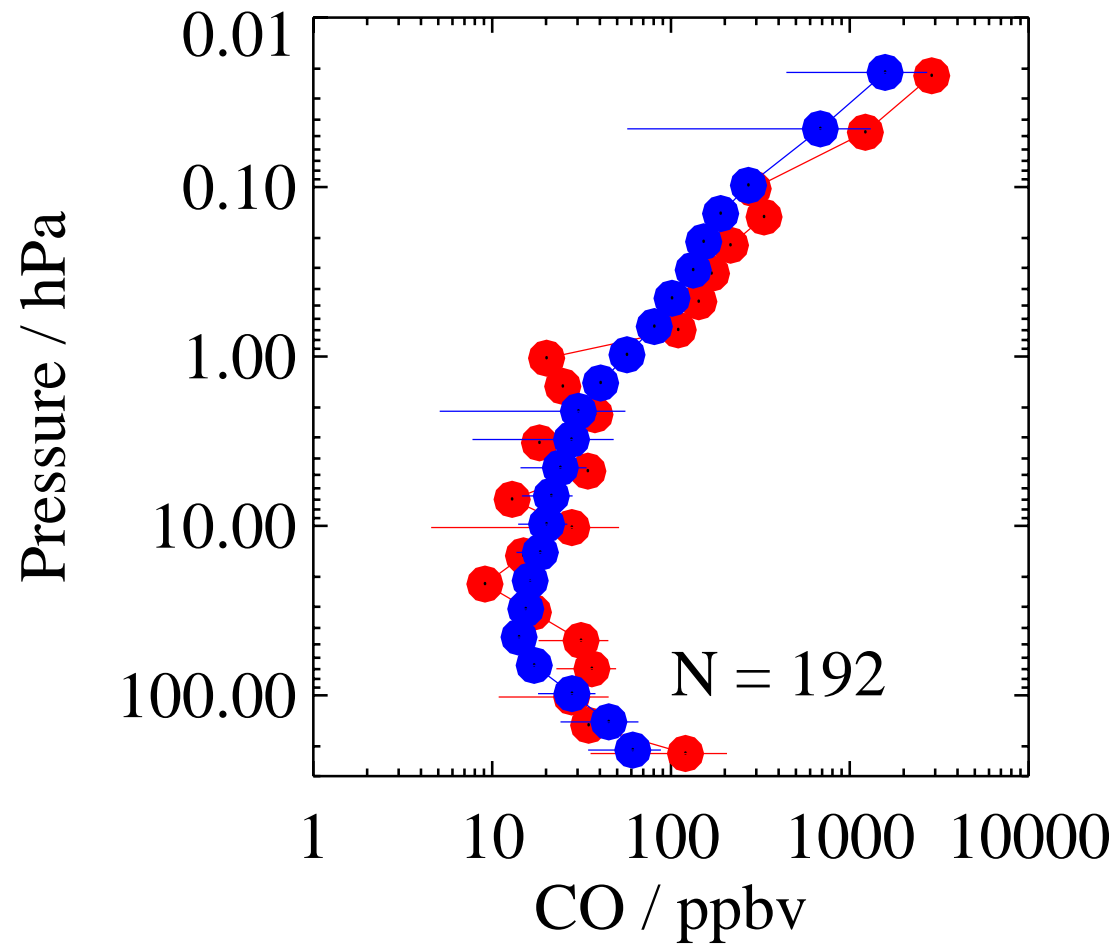
- Two major artefacts in the MLS data:
- Oscillation in the mesosphere, thought to be caused by insufficient smoothing in the retrieval.
- Negative mixing ratio ( $\sim -10$  ppbv) at 30 hPa (level for minimum CO mixing ratio in ACE, and other data and models). Unknown cause.
- These artefacts make it difficult to make quantitative comparisons with ACE.
- Note also that MLS is  $\sim 2\times$  ACE at 215 hPa, consistent with the comparisons of MLS against Argus, WAS, GEOS-CHEM and TES.

## MLS and ACE CO: high latitudes 50N–90N



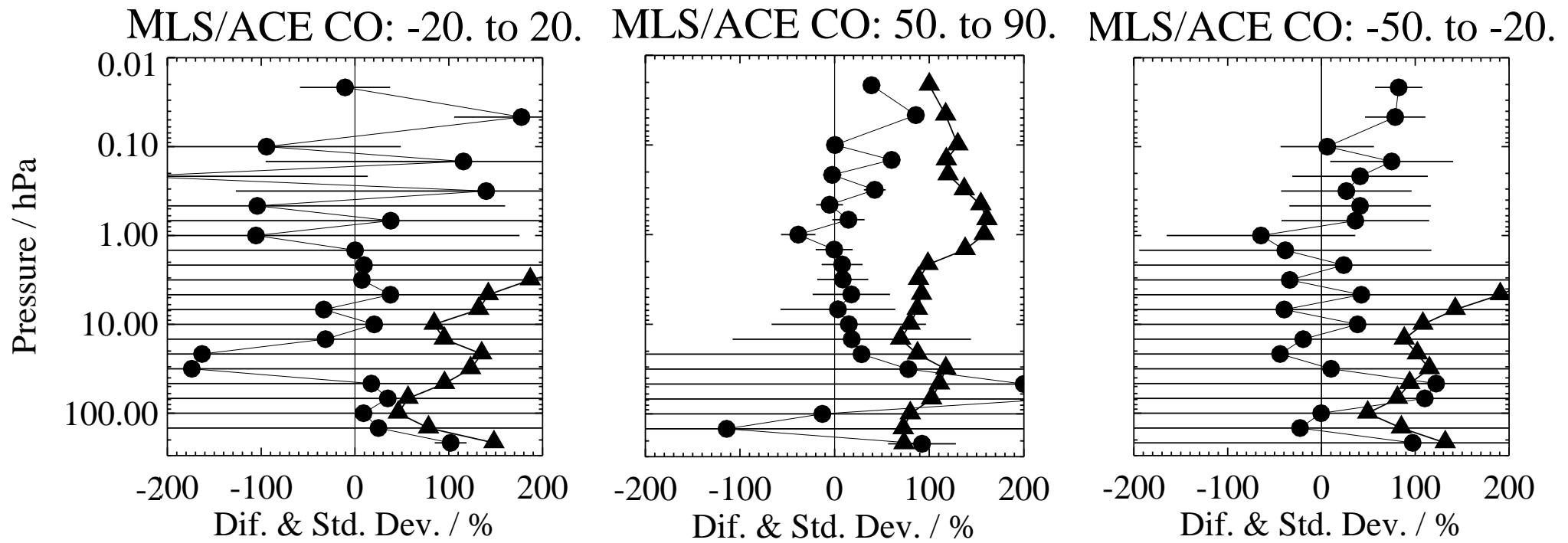
- Larger mixing ratios of CO at the poles (yearly average includes the wintertime descent of CO-rich air from the lower thermosphere into the mesosphere) mask the oscillations, which are still present.
- Negative mixing ratios are now seen at a lower altitude,  $\sim 147$  hPa.
- An additional artefact in the MLS data is the large mixing ratio of CO near 47 hPa. This is caused by the increased HNO<sub>3</sub> mixing ratios near the poles during winter: there are weak HNO<sub>3</sub> lines which have not been included in the model for the CO band.

# MLS and ACE CO: middle latitudes 20S-50S



- For this particular latitude range, there is oscillation of the MLS profiles in the stratosphere rather than the mesosphere.

## MLS and ACE CO: percent differences



- Best agreement between MLS and ACE is in the upper stratosphere, where differences are less than 50%. Scatter remains large.
- Oscillations in the MLS data are the main barrier to quantitative comparisons with ACE (and Odin-SMR).

## Summary

- Large oscillations are present in the MLS CO data.
- MLS CO data has negative mixing ratios at 30 hPa in the tropics, 150 hPa at high latitudes.
- MLS CO data has increased mixing ratios in the polar winter lower stratosphere, due to HNO<sub>3</sub> lines.
- Work on strato-mesospheric CO for version 2 of the MLS retrieval will address these issues, the most important of which is the oscillatory behaviour, which affects all levels.